18E .2000
INTERMOUNTAIN STATION
Central Reference File
No. 0.73
X 9.417
R-NRM
Publications

Research Note

NORTHERN ROCKY MOUNTAIN
FOREST AND RANGE EXPERIMENT STATION

Missoula, Montana

No. 91 March 1951

CRESTED WHEATGRASS GRAZING VALUES

E. J. Woolfolk
Division of Range Research

The most talked about forage species for range reseeding throughout the semiarid sections of the West is crested wheatgrass, (Agropyron cristatum). It has been more widely used in range reseeding trials and large-scale plantings since the great drought of the middle thirties than any other species. Over the western range as a whole stockmen and State and Federal agencies have reseeded 8 million acres of deteriorated range lands since the mid-thirties. A high percentage of this area was seeded to crested wheatgrass. In Montana 1.5 to 2.0 million acres have been seeded since 1937 and again crested wheatgrass was used on a high percentage of the area. Before World War II increased the demand and the market price for wheat about 2.0 to 2.5 million acres of Montana's deteriorated range and abandoned plowed land had been successfully reseeded to improved forage species.

Reductions in wheat acreages have already been made but only a small proportion of the cutback land has so far been put into grass. A large, additional area, farmed during the twenties and abandoned since that time is still in the "to be reseeded" category. At least some of this land must be reseeded if farm and ranch operations are sustained and the soil protected from destructive wind and water action. In many cases forage production is more profitable than wheat and less subject to the vagaries of a semiarid climate. Therefore, reseeding is a "must" on abandoned plowed areas in Montana and other parts of the West. Probably crested wheatgrass will figure prominently in this reseeding and in future management of much of this land.

What is there to look forward to in terms of herbage and livestock production in the reseeding of crested wheatgrass on abandoned plowed and deteriorated semiarid range lands? This and many other questions immediately come to mind. What is usual herbage production for crested wheatgrass? How resistant is it to grazing? What is its grazing capacity, and how much beef will it produce per unit of area?

RM-FILE COPY

Answers to some of these questions have come from the record of grazing on a 46-acre area of crested wheatgrass and from the weights of cattle that grazed it over an 11-year period.

THE STUDY

The study was conducted at the United States Range Livestock Experiment Station near Miles City, Montana, by the Forest Service in cooperation with the Bureau of Animal Industry and the Montana Agricultural Experiment Station.

The area, located on a terrace along the Yellowstone River, was drilled without soil preparation to crested wheatgrass in 1936, after abandonment in 1933 for dryland cereal crop production. Because of severe drought that year a second seeding of four pounds of crested wheatgrass seed per acre was necessary to establish a stand. By 1939 the area was ready to graze. Each year, since, up to and including 1949, full use has been made of the area by grazing feeder cattle thereon, beginning in early spring and continuing as long as the animals maintained or improved their weight. The objectives of such grazing use were to determine the ability of crested wheatgrass to withstand grazing and produce beef, the spring date of readiness of crested wheatgrass for grazing under eastern Montana conditions, and the maximum length of season crested wheatgrass might be grazed annually. This does not infer that maximum use is the best practical use of crested wheatgrass over a long period.

THE GRAZING SEASON

Each spring throughout the 11-year period, careful attention was given to the growth and development of the crested wheatgrass in order that grazing might be started as early as possible. As soon as the new leaves averaged 3 to 4 inches in length, a height considered adequate to provide needed herbage, grazing was permitted. If grazing had been delayed beyond this point crested wheatgrass would have gotten ahead of the number of cattle available for the study and become coarse and stemmy with a resultant loss in grazing capacity.

On the average, grazing began on April 24. The earliest date was April 3 in 1946, and the latest May 11 in 1939. Vegetative readiness depended on spring weather, amount of precipitation and average temperatures mainly, which materially influenced herbage growth and production on the area. All but one of the years during the study started out drier than usual, if precipitation received during the first three months of each calendar year is used as an indication of soil moisture conditions at the start of the growing season. In 7 of the 11 years, average temperature was above the long-time average during April, the first month of the growing season. Thus, for most years during the study the early part of the growing season was not only drier but warmer than usual.

Table 1. -- Seasonal and annual precipitation,

Miles City, 1939-1949

Year	Winter Jan. 1 to March 31	Spring April 1 to June 30	Summer July 1 to Sept. 30	Annual Jan. 1 to Dec. 31
1939	0.87	6.40	2.13	9.87
1940	1.78	6.05	3.22	14.14
1941	0.52	6.29	8.46	17.76
1942	1.35	8.04	3.38	13.97
1943	1.08	7.79	3.92	15.01
1944	1.92	12.80	3.64	18.95
1945	1.41	5.55	4.67	12.60
1946	0.73	6.12	6.82	17.80
1947	1.64	6.37	2.79	11.75
1948	1.77	7.79	5.72	16.08
1949	2.18	2.53	1.43	8.79
11-year average	1.39	6.88	4.20	14.25
55-year average	2.01	5.79	3.66	13.06

Table 2. -- Average monthly temperatures during growing season, Miles City, 1939-1949

Month	Year											55-year average
	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	
April	48.6	41.8	45.2	49.0	51.8	47.1	41.8	53.3	43.6	48.0	52.5	45.8
May	61.8	60.0	60.4	52.7	53.8	59.6	51.9	52.8	54.2	58.0	60.9	56.0
June	61.6	67.6	65.8	61.3	62.5	60.8	58.5	65.0	61.4	65.0	65.8	65.4
July	77.1	76.8	75.8	73.0	73.4	70.1	73.9	75.8	77.0	71.6	73.5	72.2
August	71.8	74.8	72.1	70.2	72.6	67.8	71.6	70.5	75.2	74.0	75.8	71.0
September	62.2	68.4	55.8	58.6	58.6	60.4	56.8	59.4	59.9	65.4	59.3	60.7

Spring and summer rainfall during the 11-year study period was somewhat above the long-time average. Several individual years were average or better. However, the last year of the study, 1949, was extremely dry during spring and summer in relation to both the 11-year and long-time averages. Late winter precipitation that year was above average but the spring period was very dry and warmer than usual. These conditions delayed the start of growth and materially reduced herbage production. In three years grazing began on the same date or earlier than in 1949, but in all other years the grazing season opened much later.

Spring-summer grazing ended on August 9 as a rule. Each year grazing was permitted until forage became dry and sparse and the cattle started to lose weight. The earliest closing date was June 14, 1949, and the latest September 25, 1940. The effect of rainfall and average temperature on the closing date of grazing was somewhat more noticeable than in the case of opening date. At least the years with lowest growing season precipitation and highest average growing season temperatures, 1939 and 1949, provided the shortest grazing seasons. It does not follow, however, that grazing was prolonged proportionately with increased summer rainfall because intensity and distribution of summer storms operate to upset such a relationship.

In 1940 the crested wheatgrass, then 4 years old, provided summer grazing for 141 days. In three other years, 1943, 1944, and 1945, the spring-summer grazing season extended 140 days. The shortest season, 43 days, was in 1939 and the average for the 11-year period was 107 days.

During four years, 1940, 1941, 1942, and 1946 early fall rains provided sufficient fall growth to permit grazing. These periods of fall use averaged 27 days in length beginning October 1. September 18 was the earliest that fall grazing was possible and in one year, 1940, it was permitted until November 12. Unusually warm weather during September and October in 1940 provided good growing conditions which undoubtedly made possible this late fall grazing.

GRAZING USE

In this experiment, as formerly stated, it was desired to determine the maximum season crested wheatgrass could be grazed annually and to assay its ability to withstand grazing. Therefore, the record of grazing use serves largely as a log of events rather than a guide to how crested wheatgrass should be grazed for high sustained production.

The first year, 1939, and the last, 1949, gave the smallest amounts of grazing use. In 1939, 43 days of grazing by 23 yearling steers totalled 589 animal unit days.1/ Grazing use in 1949 was about the same as in 1939

1/ An animal unit day is equivalent to one day's grazing by a mature 1,000 pound cow. A yearling day is considered six-tenths and a two-year-old day three-fourths of an animal unit day.

but in 1947 and 1948, the two previous years, 83 and 74 percent more use was made of the area. The greatest amount of grazing use, 1,846 animal unit days, was obtained in 1946. The six previous years were also high, ranging from 1,593 animal unit days in 1940 to the 1946 peak. For this seven-year period, 1940 through 1946, an average of 1,743 animal unit days of grazing use was taken annually from the 46-acre crested wheatgrass area.

Over the entire 11-year period a total of 15,391 animal unit days of grazing was taken from the area. This means an average of 1,399 animal unit days per year or 30 animal unit days per acre per year from the 46-acre area. In addition to this use by livestock, grasshopper infestations reached serious proportions in several years. The last two years, 1948 and 1949, were notable in this respect.

FORAGE PRODUCTION

Determination of crop production on agricultural land generally amounts to a rather simple process of harvesting and weighing. On grazing land, however, the situation is more difficult. If the vegetation is grazed, obviously it cannot be harvested and weighed and vice versa.

In this study, as in many similar cases, the best estimate of forage production can be derived from the complete record of grazing use. This derivation is dependent, however, upon one assumption, i.e., the weight of dry herbage required to maintain an animal unit for one day. Since animal unit days of grazing in this test have been converted to a 1,000 pound animal basis and Morrison's feeding standards call for 19 to 23 pounds of dry matter daily for an animal of that weight, an arbitrary allowance of 20 pounds of air-dry vegetation has been chosen for our purpose.

Applying this factor or allowance to the total animal unit days of grazing use, 15,391, obtained from the crested wheatgrass area during 11 successive years, we find that 307,812 pounds or 154 tons of crested wheatgrass herbage were grazed from the area by the experimental cattle. This calculated yield averages 14 tons per year for the entire area, 3-1/3 tons per acre over 11 years, or 0.30 tons per acre per year.

The cattle harvested the lowest amount of herbage in 1939, 256 pounds per acre. Only 259 pounds of herbage were grazed from each acre in 1949, but during the previous two years, the cattle removed 424 and 447 pounds. For the other years weight of herbage grazed ranged upward to 802.4 pounds, the peak, in 1946.

Northern Great Plains ranges in good condition and properly stocked can be expected to provide about 236 pounds of herbage per acre annually for grazing. This figure is based on the assumed herbage allowance of 20 pounds per animal unit day and a stocking rate of 30.5 acres of range per animal unit yearlong. The calculated average dry weight of crested wheatgrass herbage harvested by the cattle in this test, i.e., 0.3 ton per acre per year for 11 years, exceeds the calculated weight of herbage from conservatively stocked native range by 2.8 times.

BEEF PRODUCTION AND LIVESTOCK GAINS

It is one thing to grow grass and something else to grow good grass, that will convert readily into high livestock gains.

During 11 years this 46-acre crested wheatgrass area produced 40,770 pounds of beef; enough to provide a village of 680 people for an entire year or 16 families of four persons each for 11 years. The market value of that beef, figured at $25.00 per hundred weight, the average price received by United States farmers for beef cattle in November 1950, is $10,192.50. Back in 1936 it cost less than $200.00 to seed this abandoned field to crested wheatgrass.

Beef production per year averaged 3,706 pounds or 80.5 pounds per acre per year. Even though market prices fluctuated during the period of the study the income per acre for beef grown on this area was from $5.00 to $20.00 per year - a pretty good return for five dollars' worth of reseeding per acre!

From the standpoint of livestock gains, both per head and per head per day, the record is equally outstanding. During the period of the study yearling steers were used during seven seasons, mixed yearling steers and heifers one season, two-year-old steers two seasons, and two-year-old heifers one season.

Yearling steers gained an average of 183 pounds per head during the seven seasons they grazed the crested wheatgrass. For these seven seasons, which averaged 113 days in length, the daily gain in weight per steer was 1.6 pounds. In three of these years the steers were returned to the crested wheatgrass for a 28-day period of grazing in the fall. Average weight gains were 24 pounds per steer or 0.9 pounds per steer per day during the fall periods.

In 1940 when mixed yearling steers and heifers were grazed, the spring-summer season extended only 84 days but gains averaged 148 pounds per animal or one and three-fourths pounds per head per day.

In lieu of yearling cattle two-year-old steers were used in 1947 and 1948. These animals, range wintered with a small allowance of cottonseed cake, were taken directly from native grass to the crested wheatgrass. For the two seasons their average weight gain was 274 pounds in 95½ days or 2.9 pounds per head per day. The two-year-old heifers used in 1949 were midway between the yearling and two-year-old steers. They gained 113 pounds on the average in 56 days or an even two pounds per head per day.

These data indicate good performance of four classes of cattle on crested wheatgrass each for one or more seasons. They do not, however, show the fluctuations in performance that actually occurred. Some groups got off to a good start when conditions were favorable and continued so throughout the season as did the two-year-old steers in 1947. They started on April 22 at an average weight of 792 pounds and gained 4.5 pounds per

(Page 7a follows).

Feeder steers do well on green, succulent crested wheatgrass.

head per day for 56 days. Others started more slowly but made good gains later in the season. Still others varied throughout the season as rainfall affected the quality of the crested wheatgrass herbage.

EFFECTS OF GRAZING

As stated earlier one of the objectives of this study was to determine the resistance of crested wheatgrass to livestock grazing. It is clear now that the use described herein was perhaps too heavy for high sustained production of crested wheatgrass under the given conditions. Grasshopper damage, particularly in 1948 and 1949, intensified the effects of grazing and undoubtedly weakened the crested wheatgrass plants.

Utilization surveys conducted at the close of the grazing season in some years showed that stubble heights ranged from 1.5 to 3.8 inches. The cattle grazed from 60 to 100 percent of the plants depending on weather and other conditions. These figures plus the actual record of grazing use indicate that utilization was at least 2½ times heavier than that recommended for native northern Great Plains range in good condition.

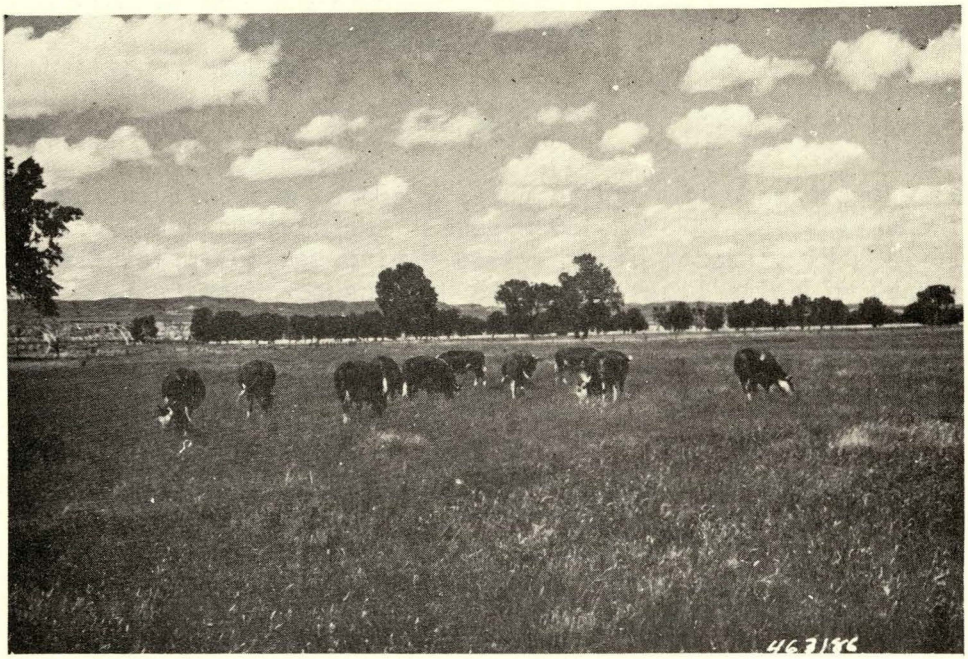
The first noticeable reaction of the crested wheatgrass to grazing use was a decrease in height growth accompanied by a tendency toward finer leaves and fewer seed stalks. Many interested stockmen observed the reaction by following the study from the beginning. As heavy grazing continued, a thinning out of the crested wheatgrass plants occurred and small patches of annual weeds and grasses began to appear in 1948 and 1949 in a once heavy stand of crested wheatgrass. With thinning of the stand came a trend toward taller, coarser growth of crested wheatgrass leaves and stems. Compared to its condition in 1939 the crested wheatgrass stand now is thinner and there are more weeds scattered throughout.

THE 1950 RECORD

Even though heavily grazed for 11 successive years the area still had considerable grazing value in 1950. In the interim between the study described and the next one planned, 12 dry cows were placed in the crested wheatgrass area. On May 3, when grazing began, these cows averaged 1,017 pounds in weight. Twenty-eight days later they weighed 1,120 pounds having gained 3.7 pounds per head per day. During the second 28-day period they gained 4.7 pounds per head per day and averaged 1,252 pounds in weight on June 28. From then until July 26 they gained only 0.3 pounds per day or 9.0 pounds per head. Grazing continued until August 18 and the cows finished at an average weight of 1,314 pounds. They gained 2.8 pounds per head per day throughout the 106-day season or a total of 297 pounds each.

Grazing use amounted to 1,634 cow days or 54.5 cow months in 1950. Part of this use was by trespass bulls that were not included in the weight record. A survey of utilization was not made but grazing use during 1950

(Page 8a follows).



After 11 years of heavy grazing crested wheatgrass still produced abundant herbage. (Photo taken July 20, 1950.)

was very light judging from the remaining old herbage. This old herbage will probably have to be removed by mowing before next grazing season to secure full use of the new herbage produced. A large proportion of this unused herbage could have been safely utilized without damage to the crested wheatgrass stand.

RESUME

Several important lessons in the grazing of crested wheatgrass were learned during this 11-year experience. Perhaps foremost of these is the fact that crested wheatgrass, for spring and early summer grazing, is a highly palatable, nutritious grass capable of producing rapid gains in feeder cattle. In the event of early fall rains it will renew growth and provide considerable grazing until or even after frost occurs. These two seasons, spring-early summer and fall, are undoubtedly the best times of the year to graze crested wheatgrass.

Crested wheatgrass is extremely resistant to grazing use but for sustained high production without damage to the stand it should probably be grazed somewhat lighter than the area described herein. In other words, stocking over a period of years under eastern Montana conditions should perhaps be slightly under one animal unit month per acre with considerable freedom to vary the start and length of the grazing season in accordance with prevailing weather conditions. Such stocking would permit good use of the crested wheatgrass and still provide a cushion against dry years and grasshopper attacks which tend to lower the vitality of forage plants and reduce stand density.

Under semiarid eastern Montana conditions crested wheatgrass will on the average be ready to graze between early April and early May, most often during late April. In every case herbage growth should be sufficient to provide adequate forage and the soil dry enough to prevent excessive damage to the plants through trampling.

Depending upon weather, grasshopper infestations and other factors the spring-summer grazing season on crested wheatgrass may extend to 140 days in length. Usually a spring-summer grazing season of 100 to 120 days can be expected. Crested wheatgrass will provide some fall grazing in about a third of the years over a long period under eastern Montana conditions.

Montana and the semiarid West needs more crested wheatgrass acreage. At the present time seed supplies are abundant and prices nominal, 20 to 35 cents per pound. On abandoned croplands successful stands can be established by drilling 4 or 5 pounds of seed per acre, usually in the fall, without soil preparation. In the case of deteriorated range lands reduction or removal of existing vegetation prior to drilling is usually necessary and advisable. In all cases the seed must be lightly covered and the seeded area protected for at least one or two growing seasons after planting to insure success.

Land administrators, both public and private, should give careful attention to the balance between reseeded crested wheatgrass range and other

types of range on any one management unit. Too much crested wheatgrass acreage in proportion to other range types or hay crop acreages will create summer grazing and haying problems which are difficult to handle without loss of grazing value or quality and tonnage of hay. Where watershed values are involved or soil erosion is being arrested with crested wheatgrass plantings, grazing and hay values have low priority. Generally, however, the wise use of crested wheatgrass on abandoned plowed, or otherwise deteriorated range lands in Montana and the West holds considerable promise for increased forage and livestock production.